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**In RE: Application of Sadayoshi TERADA, et al**

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Hon. Commissioner of Patents  
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Sir:

In response to the Office Action dated December 20, 2006 and in addition to the amendment dated April 12, 2007, please accept the following marked-up copy of the original specification filed under M.P.E.P. 608.01 (q), which shows the changes made to obtain the substitute specification:

## **In the Specification:**

The following marked-up copy of the original specification is warranted to contain no new matter.

### **ABSORBENT ARTICLE HAVING DEVIDED ABSORBENT CORE ABSORBENT ARTICLE WITH AN ABSORBENT CORE DIVIDED BY INTERSECTING PASSAGES CROSS-REFERENCE**

[0001] This is the U.S. National Stage of PCT/JP 2004/003526, which was filed March 17, 2004 in Japan and which entered the U.S. National Stage in accordance with 35 U.S.C. 371, which, in turn, claims the benefit of priority of invention under 35 U.S.C. 119 based on JP 2003-71869, filed March 17, 2003, in Japan.

### **FIELD OF THE INVENTION BACKGROUND OF THE INVENTION**

#### **1. The Field of the Invention**

[0002] The present invention relates to an improved absorbent article such as a disposable diaper or a sanitary napkin, and more particularly to an absorbent article containing a flat absorbent core, in which the absorbent core is sandwiched between a liquid permeable front sheet and a liquid impermeable back sheet ~~divided into plural portions by means of at least one hollow gap (ditch), and sandwiched between a front surface sheet and a back surface sheet so as to maintain the configuration, which allows the absorbent core to perform its inherent liquid absorbency.~~

#### **BACKGROUND OF THE INVENTION 2. The Related Art**

[0003] An absorbent article such as a disposable diaper or a sanitary napkin is basically composed of a flat absorbent core having excellent liquid absorbency, which is

sandwiched between a liquid permeable front sheet and a liquid impermeable back sheet. In most conventional absorbent articles ~~[[,]]~~ ~~[[a]]~~ the flat absorbent core is bonded ~~adhered to both front and back surface-sheets with a hot melt adhesive in order to prevent the core part from slipping and shifting being displaced between the sheets.~~

**[0004]** However ~~[[,]]~~ bonding the ~~such an adhesion of an absorbent core and both sheets using a hot melt adhesive is not preferred because it impairs the absorbance of the core preferable as it impairs an absorbency property of an absorbent core to some extent. Especially, when a hot melt adhesive is used to bond the front glue a front surface-sheet with the and an absorbent core, there exists a hardened adhesive is present~~ ~~[[on]]~~ the interface between the front surface-sheet and the absorbent core, which reduces the liquid permeability of the front ~~surface-sheet~~ and the absorbency of the absorbent core.

**[0005]** ~~As an~~ An absorbent article is known from Unexamined Japanese Utility Model Application Publication No. H1-14707, in which a hot melt adhesive is not applied ~~used on the interface between the~~ ~~[[a]]~~ flat absorbent core and the ~~[[a]]~~ front ~~[[and]]~~ or back surface-sheet and in which the ~~[[a]]~~ flat absorbent core is not leaned or displaced between the front and the back surface-sheet ~~[[,]]. In this absorbent article the one in which an absorbent core is divided into parts and the periphery of each part is plural portions, the periphery of each portion fixed firmly to the front sheet and the back surface-sheet is known (See Reference 1).~~ In this absorbent article, ~~as all~~ since the periphery of the divided portions of the flat absorbent core is surrounded by the joint ~~[[of]]~~ between the front ~~surface-sheet~~ and the back ~~surface-sheet~~, deviation or slippage can be prevented without gluing the flat absorbent core and the above sheets with a hot

melt adhesive. In addition to the above known article ~~[[,]]~~ ~~there is known~~ a conventional absorbent article is known from Unexamined Japanese Patent Application Publication No. H9-51913, ~~having holes on a front surface side in which an absorbent core is arranged intervenes between a liquid pervious front sheet and a liquid impervious back sheet and extends in the longitudinal direction of those sheets[[,]]~~ ~~in which a~~ A plurality of holes is provided that are arranged to extend in towards the longitudinal direction and penetrate while piercing the thickness direction of the core the absorbent core. ~~in which the~~ The front and back sheets adhere ~~are adhered along the holes in a non-removable manner so that the front sheet forms grooves~~ ~~ditches extending along the above holes (see Reference 2).~~ Furthermore, as another example, ~~there is known~~ a disposable diaper is known from Unexamined Japanese Patent Application Publication No. 2002-165834 comprising an absorbent article composed of a liquid pervious front sheet, a liquid impervious back sheet, and an absorbent core which is arranged between these sheets. ~~intervenes therebetween in which the~~ The absorbent core is covered with an absorbent diffusible sheet in such a manner that at least one depression or groove ~~ditch~~ is provided on the front sheet side of the absorbent core, which extends in a ~~[[the]]~~ direction from the front sheet to the back sheet so that a bottom part and a side wall part of the depressions or grooves ~~ditch~~ are covered with the front sheet. In this absorbent article ~~in which the absorbent core comprises absorbent fibers and super absorbent polymer particles, which are arranged said absorbent fibers and super absorbent polymer particles intervene between the front sheet and the back sheet on the bottom part of the depression~~ ~~ditch (see Reference 3).~~

~~Reference 1: Utility Model application unexamined publication No. H1-14707~~

~~Reference 2: Patent application unexamined publication No. H9-51913~~

~~Reference 3: Patent application unexamined publication No. 2002-165834~~

**[0006]** In the ~~[[a]]~~ conventional absorbent ~~articles~~ article-described above ~~[[,]]~~ a groove or depression there is an advantage in that a hole or a ditch functions as a guide for liquid discharged on a front sheet. However ~~surface sheet~~; however, since an absorbent core adjacent to the groove or depression is under pressure from the front sheet, ~~the a~~ hole or a ditch is pressured with a front surface sheet, it causes a disadvantage in that inherent liquid absorbency of ~~the~~ [[an]] absorbent core is disadvantageously decreased in proximity to the groove or depression ~~a hole or a ditch~~.

**[0007]** That is, in a conventional absorbent article ~~[[,]]~~ a groove ~~hole or a~~ depression ditch is generally formed so that in such a manner that a front surface sheet and a back surface sheet are opposed so as to have a flat absorbent core therebetween in which the front sheet sinks toward ~~[[into]]~~ the back sheet side of the absorbent core to adhere thereto at each place at which the groove or depression ~~that a hole or ditch~~ is provided. Thereby, a flat absorbent core adjacent to the groove or depression ~~a hole or a ditch~~ through a front surface sheet is under ~~[[the]]~~ pressure by the front surface sheet, which inconveniently causes inconvenience in which the inherent absorbent capacity capability of the absorbent core ~~[[is]]~~ to be impaired.

### **SUMMARY OF THE INVENTION**

**[0008]** Thus it is an object of the present ~~Then, the purpose of this invention~~ ~~[[is]]~~ to provide a new absorbent article of the above-described kind, which comprises an

~~absorbent core provided with at least one passage for distributing having a hole or a ditch that functions as a guide for the liquid discharged on [[a]] the liquid permeable front surface sheet, and eliminating the above disadvantage of a conventional absorbent article, which has a groove or depression in its front sheet comprising a hole or a ditch.~~

### **SUMMARY OF THE INVENTION**

**[0009]** An absorbent article of the present invention comprises a rectangular or nearly rectangular shaped flat absorbent core arranged between a liquid permeable front sheet and a liquid impermeable back sheet. The flat absorbent core interposed between the two sheets is divided into not less than two parts to form at least one passage through the absorbent article. Each passage traverses a point within a circle, which has a radius of 25 mm and whose center coincides with the center of the absorbent article. Each passage has a depth equal to the thickness of the flat absorbent core and a width of from 2 – 6 mm. The front sheet, the back sheet, and the absorbent core are formed so that no groove or depression is observable in the front sheet or in the back sheet.

~~An absorbent article of the present invention comprises a rectangular or nearly rectangular shaped flat absorbent core interposed between a liquid pervious front sheet and a liquid impervious back sheet in which the flat absorbent core interposed between said two sheets is divided into not less than two parts by at least one ditch traversing a point within a circle with a radius of 25 mm from its center to the periphery of the flat absorbent core, in which the ditch has the same depth as the thickness of the flat absorbent core, and is 2—6 mm in width while the ditch can be neither directly seen from the front sheet side nor the back sheet side[[.]]~~

**[0010]** In contrast to the prior art absorbent article in which at least one groove or depression can generally be seen from the front side of the article, the absorbent article of the present invention does not have any observable grooves or depressions in its front side or back side. Instead in the absorbent article according to the invention internal passages through the absorbent core are provided to help distribute liquid passing through the permeable front sheet. Needless to say, both sidewalls of these internal passages are composed of the flat absorbent core and the liquid permeable front sheet and the liquid impermeable back sheet close the top and the bottom of the internal passages.

~~A hole or a ditch provided at a conventional absorbent article can be generally seen from a front sheet side. On the other hand, as a hole or a ditch provided at an absorbent core of an absorbent article of the present invention can be directly seen neither from a front sheet side nor a back sheet side, such a ditch will be called a hidden ditch in this specification. Needless to say, both sidewalls of this hidden ditch are composed of longitudinal section of a flat absorbent core, and the top and the bottom of the ditch are closed which is sandwiched between a liquid permeable front sheet and a liquid impermeable back sheet[.]]~~

**[0011]** In preferred embodiments of the invention at least two intersecting passages are provided in the absorbent article, which divide the absorbent core into at least four separate parts. The at least two intersecting passages intersect at a common intersection point that is within a circle with a radius of 25 mm, whose center coincides with the center of the absorbent article.

**[0012]** In an especially preferred embodiment of the invention the absorbent core is divided into eight separate parts by three intersecting passages through the absorbent core, which extend between respective opposite sides of the absorbent article, or between opposite corners, or between opposite peripheral edges of the article. Each of the intersecting passages traverses a central intersection point within a circle with a radius 25 mm, whose center coincides with the center of the absorbent article. In some embodiments the central intersection point is located at the center of the absorbent article.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0013]** The objects, features and advantages of the invention will now be illustrated in more detail with the aid of the following description of the preferred embodiments, with reference to the accompanying figures in which:

FIG. 1 is a partially plan, partially sectional view showing an example of an absorbent article in which a flat absorbent core is divided into two parts by a ~~hidden ditch~~ single central passage extending in the longitudinal direction from one side of the article to the opposite side ~~and imposed between two sheets~~[[.]];

FIG. 2 is a sectional view taken ~~[[off]]~~ along the section line II-II ~~[[A-A]]~~ of FIG. 1 ~~[[.]]~~;



FIG. 3 is a partially plan, partially sectional view showing an example of an absorbent article in which a flat absorbent core is divided into three parts by two passages ~~hidden-ditches~~ extending in the longitudinal direction ~~and imposed~~ between two sheets~~[[.]]~~;

FIG. 4 is a sectional view taken ~~[[off]]~~ along the line IV-IV ~~[[A-A]]~~ of FIG. 3~~[[.]]~~;

FIG. 5 is a partially plan, partially sectional view showing an example of an absorbent article, in which a flat absorbent core is divided into four parts by three through-going passages ~~hidden-ditches~~ extending in the longitudinal direction ~~and imposed~~ between the front and back ~~two~~ sheets~~[[.]]~~;

FIG. 6 is a sectional view taken ~~[[off]]~~ along the line VI-VI ~~[[A-A]]~~ of FIG. 5~~[[.]]~~;

FIG. 7 is a partially plan, partially sectional view showing another example of an absorbent article according to the invention, in which a flat absorbent core is divided by a plurality of through-going intersecting passages ~~hidden-ditches~~ extending radially ~~and imposed~~ between the front and back ~~two~~ sheets~~[[.]]~~;

FIG. 8 is a partially plan, partially sectional view of a modified example of the absorbent article according to the invention shown in FIG.7; and

FIG. 9 is a vertical sectional view of a liquid injection pipe used in a circular diffusion experiment of saline solution.

## **DESCRIPTION OF THE PREFERRED EMBODIMENTS EMBODOMENTS**

**[0014]** In this specification, disposable diapers and sanitary napkins are collectively called absorbent articles. However, there are many kinds of absorbent articles, such as with embossing, or with ~~these~~ cuffs and/or gathers with elastic materials, which ~~are~~ provided in order to improve the fitting properties and leakage prevention. In addition,

various suggestions have been are-made, for example, about the form and positioning of closures provided on disposable diapers~~[[,]] such as its form or positioning~~. However, such an absorbent article is basically composed of a rectangular or nearly rectangular shaped flat absorbent core interposed between a liquid pervious front sheet and a liquid impervious back sheet regardless of the kind of the article.

**[0015]** In this specification~~[[,]]~~ a nearly rectangular shaped flat absorbent core means ~~indicates a flat absorbent core, in which the wherein~~ four corners and/or crotch portions (coxitic part) of a rectangular shaped flat absorbent core are trimmed. Therefore, such a nearly rectangular shaped flat absorbent core includes an oval shaped absorbent core and an absorbent core whose plane form is guitar-shaped or hour glass-shaped.

**[0016]** Any liquid pervious sheet, liquid impervious sheet, or absorbent core used in manufacturing conventional absorbent articles can be employed for a front surface sheet, a back surface sheet, or an absorbent core of an absorbent article according to the present invention.~~[[.]] Namely, an~~ The absorbent core is generally a laminated body or a flat shaped article ~~[[form]]~~ composed of, for example, fluffed wooden pulp, super absorbent polymer, synthetic fibers, or the like. Most of a flat absorbent cores ~~core~~ ~~interposed between the front and back two sheets generally~~ have a uniform ~~has the~~ same thickness. However, the thickness of a central portion can be greater ~~thicker~~ than that of a surrounding portion.

**[0017]** The most distinctive feature of the absorbent article of the present invention is that a rectangular or nearly rectangular shaped flat absorbent core arranged interposed between a front surface sheet and a back surface sheet is divided into not less than two parts by at least one through-going passage ~~ditch~~ traversing one point within a circle

with a radius of 25 mm from ~~[[a]] its center of its plane~~ (hereinafter so called as “a center circle”) to the periphery of the flat absorbent core article. This ~~passage in which the ditch~~ is 2 – 6 mm in width while the ~~passage is hidden so that it ditch is a hidden ditch which~~ can be directly seen neither from the front-sheet side nor the back-sheet side.

**[0018]** ~~When a gap or passage~~ In a case that a ditch dividing a flat absorbent core into not less than two parts extends in two directions from one point within the aforementioned center circle, the two directions are typically opposite from each other in ~~an opposite direction of each other~~. However, the directions do not need to be accurately exactly opposite. In other words, each gap or passage ditch dividing ~~[[a]] the~~ flat absorbent core ~~in the thickness direction~~ may, for instance, bend within the center circle. ~~The~~ Therefore, a flat absorbent core of the invention can be divided into a plurality of parts by more than one hidden passage ~~[[ditch]]~~ extending radially from one point within the center circle to the periphery of the absorbent core.

**[0019]** FIGs. 1 - 8 depict various embodiments of absorbent articles of the invention, wherein ~~[[a]] the~~ flat absorbent core is divided or partitioned into a plurality of parts by one or more than two hidden passages and ~~ditches in which~~ the absorbent core is interposed between a liquid permeable ~~pervious~~ front sheet and a liquid impermeable ~~impervious~~ back sheet. In the illustrated absorbent articles ~~[[, a]] the~~ rectangular shaped absorbent core is embodied ~~utilized as a flat absorbent core that is before being divided~~ or partitioned into parts by gaps or hidden passages ~~ditch(es)~~. However, as explained previously, a nearly rectangular shaped absorbent core of which four corners and/or crotch portions are trimmed can replace the foregoing ~~be replaced with the above~~ absorbent core. When a crotch portion of an absorbent core used in an absorbent

article is trimmed so as to deform its plane figure into ~~[[a]]~~ an hourglass shape or a guitar-shape, crotch portions of the corresponding ~~[[a]]~~ front sheet and ~~[[a]]~~ back sheet interposing the core therebetween may be trimmed as well.

**[0020]** FIGs. 1 - 8 show examples in which the ~~plane-form~~ of both front sheet and back sheet are also rectangular ~~rectangle~~-similar to that of ~~[[a]]~~ the flat absorbent core for convenience. This does not imply ~~Thereby, it does not mean~~ that a front surface sheet and a back ~~surface-sheet~~ of an actual absorbent article are actually rectangular rectangle. Incidentally, in disposable diapers, in case that a rectangular or nearly rectangular shaped flat absorbent core is used, the portions of a front sheet and a back sheet which surround the waist and the stomach when applied to the human body are generally extended in a wing shape. Therefore, in case of applying the present invention ~~absorbent article~~ to a disposable diaper, this sort of ~~such~~ a wing-shaped extension is provided on both front sheet and back sheet ~~interposing the flat absorbent core therebetween~~.

**[0021]** In addition, although it is not illustrated, according to the invention, it is possible to apply embossing finish on an absorbent article to improve fitting properties and leakage prevention when applied to the human body. Cuffs and/or gathers composed of elastic materials can be provided as well. Further, in a disposable diaper, various types of closures can be provided for fixing around the waist.

**[0022]** In the drawings, reference numeral 1 denotes a liquid pervious or permeable inner or front sheet, and reference numeral 2 denotes a liquid impervious or impermeable outer or back sheet, while reference numeral 3 denotes a flat absorbent core which is divided by a hidden passage ~~ditch~~-4 in the thickness direction.

**[0023]** In an absorbent article shown in FIG. 1, a rectangular shaped flat absorbent core is divided by a single passage ditch extending in the longitudinal direction in ~~[[at]]~~ the center and ~~interposed between~~ the front and back ~~two~~ sheets. FIG. 3 shows the absorbent article, ~~wherein~~ in which a rectangular shaped flat absorbent core is divided by two passages ditches arranged parallel to the center line extending in the longitudinal direction so that the center line is between them ~~as to interpose it therebetween~~. FIG. 5 denotes an absorbent article, in which ~~wherein~~ a rectangular shaped flat absorbent core is divided into four parts by three passages ditches extending in the longitudinal direction ~~at the center~~.

**[0024]** In any absorbent article ~~[[,]]~~ it is preferable for a passage ditch extending in the longitudinal direction to traverse a circle C with a radius of 25 mm (a center circle), whose center is a center of the flat absorbent core, but it is not necessary for each passage ditch to be straight. For instance, in the absorbent core shown in FIG.5, since ~~[[as]]~~ all three passages ditches extending in the longitudinal direction must have to traverse the center circle C, the passage ditch arranged at the center is typically straight while the other two passages ditches arranged on both sides of the center one can have greater distance from ~~[[to]]~~ each other at the edge of ~~as they leave from the center circle~~. In other words, each of the two passages ditches arranged on both sides of the center passage ditch arranged at the center may be angular, i.e. may bend within the center circle.

**[0025]** FIGs. 7 and 8 denote an absorbent article, in which ~~wherein~~ a rectangular shaped flat absorbent core is divided into a plurality of parts by more than one hidden passage ditch extending radially from one point P within a center circle C to the

periphery of a flat absorbent core, particularly to an edge or corner of the article. In the ~~[[an]]~~ absorbent article shown in FIG. 7, ~~[[a]]~~ the starting point of the passage ditch extending radially is at the center of the rectangular shaped absorbent core or article. In this embodiment three passages, each of which extend from either opposite sides or opposite corners of the article, divide the absorbent core into eight separate parts. The embodiment shown in fig. 8 is generally similar to that shown in fig. 7. However, in FIG. 8, ~~[[a]]~~ the starting point P of the passage ditch extending radially is not at the center of the rectangular shaped flat absorbent core but is within the center circle C, whose center is the center of the absorbent article or core. A circle depicted with a dotted line indicates the aforementioned center circle C with a radius of 25 mm.

**[0026]** In each of the illustrated absorbent articles ~~[[,]]~~ a hidden passage 4 is bounded by ditch 4 ~~comprises~~ sidewalls composed of the parts of the sections of a flat absorbent core and by the ~~in which~~ a liquid pervious front sheet and ~~[[a]]~~ liquid impervious back sheet ~~[[are]]~~ arranged on ~~[[at]]~~ the top and the bottom of the hidden passage ditch. Accordingly, the hidden passage 4 ditch 4 ~~is hollow, and~~ cannot be seen directly from either the front sheet side or back sheet side of the absorbent article.

## EXAMPLES

**[0027]** ~~The We will explain the present invention is explained herein below~~ more concretely by means of showing some examples, as follows; however ~~[[,]]~~ However the examples are not intended to limit the claims appended herein below ~~present invention~~.

### Example 1

**[0028]** ~~With air laid equipment, five layered absorbent core whose weight percentage of NBSK fiber / thermally bonded fiber / super absorbent polymer is 47.1/4.3/48.6 is~~

prepared ~~[[.]]~~ A five-layer absorbent core containing 47.1 % by weight of NBSK fiber, 4.3 percent by weight of thermally bonded fiber, and 48.6 percent by weight of super absorbent polymer was prepared with air laid equipment.

1<sup>st</sup> Layer: NBKP fiber  $55 \text{ g/m}^2$  + Thermally bonded fiber  $5 \text{ g/m}^2$  =  $60 \text{ g/m}^2$

2<sup>nd</sup> Layer: Super absorbent polymer  $85 \text{ g/m}^2$  =  $85 \text{ g/m}^2$

3<sup>rd</sup> Layer: NBKP fiber  $55 \text{ g/m}^2$  + Thermally bonded fiber  $5 \text{ g/m}^2$  =  $60 \text{ g/m}^2$

4<sup>th</sup> Layer: Super absorbent polymer  $85 \text{ g/m}^2$  =  $85 \text{ g/m}^2$

5<sup>th</sup> Layer: NBKP fiber  $55 \text{ g/m}^2$  + Thermally bonded fiber  $5 \text{ g/m}^2$  =  $60 \text{ g/m}^2$

Total:  $350 \text{ g/m}^2$

**[0029]** A 36 cm X 15 cm flat absorbent core was cut off from the thus obtained absorbent core sheet, divided into two parts by a 6 mm wide gap ditch along the center line in the longitudinal direction. A so as to apply  $20 \text{ g/m}^2$  basis weight of Asahikasei Erutasu Aqua was applied onto a front sheet and a 25  $\mu$  thick PE film was applied onto a back sheet. The absorbent core, the front sheet, and the back sheet were assembled as shown in FIG. 1 to obtain an absorbent article as core shown in FIG. 1.

#### Example 2

**[0030]** The same procedure of example Example-1 was repeated to obtain an absorbent core article as shown in FIG. 1, except for changing the width of the passage ditch to 4 mm.

#### Example 3

**[0031]** The same procedure of example Example-1 was repeated to obtain an absorbent core article as shown in FIG. 1, except for changing the width of the passage ditch to 2 mm.

#### Example 4

[0032] An absorbent article as shown in FIG. 3 was obtained by using the same size flat absorbent core and the same front sheet and back sheet as in example Example-1. In this article [[,]] each of the two passages ~~ditches~~-was 6 mm wide [[,]] and a belt-like strip-shaped absorbent core ~~interposed between those passages~~ ~~ditches~~ was 25 mm wide.

#### Example 5

[0033] The ~~same~~-procedure of example Example 4 was repeated to obtain an absorbent ~~core~~-article as shown in FIG. 3, except for changing the width of the passages ~~ditches~~-to 4 mm.

#### Example 6

[0034] The ~~same~~-procedure of example Example 4 was repeated to obtain an absorbent ~~core~~-article as shown in FIG. 3, except for changing the width of the passages ~~ditches~~-to 2 mm. Example 7

#### Example 7

[0035] An absorbent article shown in FIG. 5 was obtained by using the same size flat absorbent core and the same front sheet and back sheet as in example Example-1. In this article [[,]] each of three passages, which extend longitudinally between opposite sides of the flat absorbent core, ~~ditches~~-was 6 mm wide. One ~~wherein one of those passages~~ ~~ditches~~-was arranged along the center line of the flat absorbent core in the longitudinal direction. The width of [[,]] ~~and the width of two belt-like~~ each of two strip-like absorbent core parts on opposite sides of this center passage ~~cores~~-~~interposing the center ditch therebetween~~-was 17 mm~~[[,]]~~-respectively.



#### Example 8

[0036] The ~~same~~ procedure of ~~example~~ Example-7 was repeated to obtain an absorbent ~~core~~ article as shown in FIG. 5<sub>1</sub> except for changing the width of the passages ~~ditches~~ to 4 mm.

#### Example 9

[0037] The ~~same~~ procedure of ~~example~~ Example-7 was repeated to obtain an absorbent ~~core~~ article as shown in FIG. 5<sub>1</sub> except for changing the width of the passages ~~ditches~~ to 2 mm.

#### Example 10

[0038] An absorbent article shown in FIG. 7 was obtained by using the same size flat absorbent core and the same front sheet and back sheet as in example ~~Example-1~~. In this article ~~[[,]]~~ the flat absorbent core was divided into eight parts by passages ~~ditches~~ of 6 mm in width extending radially ~~radically~~ from the center of the flat absorbent core ~~so as to be interposed~~ between a front sheet and a back sheet.

#### Example 11

[0039] The ~~same~~ procedure of ~~example~~ Example-10 was repeated to obtain an absorbent ~~core~~ article as shown in FIG. 7<sub>1</sub> except for changing the width of the passages ~~ditches~~ extending radially ~~radically~~ from the center to 4 mm.

#### Example 12

[0040] The ~~same~~ procedure of ~~example~~ Example-10 was repeated to obtain an absorbent ~~core~~ article as shown in FIG. 7<sub>1</sub> except for changing the width of the passages ~~ditches~~ extending radially ~~radically~~ from the center to 2 mm. A liquid absorption rate, a wet back volume, and a diffusion area ratio were each measured for

~~about each absorbent article obtained in examples 1 to 12 according to the following method~~[[:]] methods described in the following paragraphs.

**[0041]** The measured results are shown in Table 1. A comparison example in table 1 reveals the measured results for result of an absorbent article obtained by repeating example Example-1, except for not dividing the flat absorbent core with a passage ditch.

Liquid Absorption Rate[[:]]

**[0042]** A measuring apparatus was prepared in which an [[An]] injection pipe having an internal diameter of 45 mm was vertically mounted on ~~connected to the central portion of an acrylic board with dimensions of 10 cm X 10 cm X 10 mm in thickness, and a measuring apparatus was prepared in which an opening of the same inner diameter as the injection pipe was provided in the central portion on the connecting part of the acrylic board. The measuring instrument was gently placed approximately on the center of a front sheet of an absorbent article that was placed spread on a plane surface. In this instance, the~~ The acrylic board [[is]] was placed in contact with the front sheet and so that the injection pipe was vertically oriented above it maintains the status in which the injection pipe stands up vertically. Then [[,]] 200 ml of an 0.9 weight percent physiological saline solution ~~of 0.9 weight percentage~~ was poured into the injection pipe from the top so as to reach ~~keep a liquid level of about 50 mm and the time (second) for absorbing all the physiological saline solution was measured. Three measuring samples of the saline solution were prepared for each absorbent article. [[,]] [[and]] The times in seconds for absorption of each saline sample by the absorbent article were measured. The average absorption time was obtained from the measured times for each saline sample time for being absorbed and average thereof was evaluated per sample.~~

#### Wet Back Amount

**[0043]** After each ~~of sample used for measuring a liquid absorbing rate, i.e., the~~ samples ~~that~~ having absorbed 200 ml of the physiological saline solution was allowed to stand ~~left~~ for 10 minutes, 30 sheets of filter papers with dimensions of 100 mm X 100 mm (trade name: Advantech No.1140, manufactured by Toyo Filter Paper Inc.) were piled onto the central portion of the absorbent article sample, and left for 5 minutes while loading 10 kg of weight thereon. Then ~~the~~ increase of weight of the filter papers was measured as the wet back amount.

#### Diffusion Area Ratio

**[0044]** A small amount of blue dye was added into the 200 ml of physiological saline solution used for measuring a liquid absorption rate as explained above. After the samples absorbed the colored saline solution, the area on the flat absorbent core through which the colored saline solution diffused ~~diffusion area of the colored saline for each sample of the flat absorbent core~~ was measured so as to evaluate the ratio of the diffusion area to ~~against~~ the whole area of the flat absorbent core (36 mm in length by 15 mm in width).

**Table 1 PROPERTIES OF EXAMPLES OF THE ABSORBENT ARTICLES OF THE INVENTION AND A COMPARISON EXAMPLE THAT IS NOT OF THE INVENTION**

Modeled Diaper	Comparison Example	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
Division of Absorbent Ditch Width (mm)	Not divided	2 parts 6	2 parts 4	2 parts 2	3 parts 6	3 parts 4	3 parts 2
Absorption Speed (sec)	66 70 70 average 69	11 11 12 average 11	15 15 15 average 15	30 27 28 average 28	8 8 8 average 8	10 10 10 average 10	23 19 19 average 20
Wet Back Amount	9.3 9.8 10.6 average 9.9	0.9 1.1 1.3 average 1.1	0.6 0.4 0.5 average 0.5	0.8 1.0 1.3 average 1.4	0.9 0.7 0.6 average 0.7	0.4 0.4 0.6 average 0.5	0.5 0.8 1.7 average 1.3
Diffusion Area Ratio	53.3	72.9	77.9	69.0	80.4	85.0	75.6

**Table 1 (con):**

Modeled Diaper	Comparison Example	Example 7	Example 8	Example 9	Example 10	Example 11	Example 12
Division of Absorbent Ditch Width (mm)	Not divided	4 parts 6	4 parts 4	4 parts 2	Radially divided 6	Radially divided 4	Radially divided 2
Absorption Speed (sec)	66 70 70 average 69	5 5 6 average 6	9 9 7 average 8	17 19 19 average 18	5 4 5 average 5	7 6 6 average 6	12 12 14 average 13
Wet Back Amount	9.3 9.8 10.6 average 9.9	0.5 0.6 0.6 average 0.6	0.3 0.5 0.6 average 0.5	0.8 1.0 1.4 average 1.1	0.4 0.3 0.5 average 0.4	0.5 0.4 0.5 average 0.5	0.7 0.8 0.9 average 0.8
Diffusion Area Ratio	53.3	84.8	83.6	75.2	93.8	92.6	84.5

[0045] It will be appreciated that each absorbent article according to examples ~~Examples~~-1 to 12 has been greatly improved not only in liquid absorption rate but also in wet back amount compared with those of the comparison example in which the ~~wherein an absorbent core is not divided by a hidden passage ditch.~~

The following experiments were carried out to ~~determine the figure-out~~ most effective position ~~for the such a hidden passages ditch to be provided in the absorbent article of the invention on a flat absorbent core.~~

**[0046]** An absorbent article was prepared by repeating the same procedure of ~~example~~ Example-1 using an identical flat absorbent core, inner surface, and outer surface, except for not being divided by a gap or passage ditch (same as a comparison example 1 of table 1). A liquid injection pipe shown in FIG. 9 was vertically positioned above the center of the absorbent article placed spread on a plane surface. ~~[[and]]~~ 200 ml of an 0.9 weight percent physiological saline solution ~~having concentration of 0.9 weight percentage~~ was poured onto the absorbent article at a flow rate of 14 ml/sec while varying ~~changing~~ the vertical distance from the outlet of the injection pipe to the absorbent article ~~at a flow rate of 14 ml/sec~~ so as to measure the time in seconds ~~(second)~~ for the saline solution to spread from the place it dropped to a concentric circle having a predetermined radius.

**[0047]** An internal diameter D of a cylindrical tube that comprises ~~composing~~ the upper half of the liquid injection pipe (FIG. 9) was 48 mm, ~~48 mm~~ while a conical tube that comprises ~~composing~~ the lower half ~~was designed to have~~ had a length of 100 mm ~~in length~~, an upper internal diameter of 10 mm ~~of upper internal diameter~~, and an internal diameter at the liquid outlet of 3 mm ~~of internal diameter of the liquid outlet~~. Furthermore, in order to maintain the average liquid flow of 14 ml/sec during the experiments, a head H of saline solution in the injection pipe was set at 215 mm before the liquid began to flow.

[0048] Table 2 shows the experimental results for the spreading times for the samples of the ~~result in which the time for the saline~~ solutions to spread from the place where they are ~~[[it]]~~ dropped to a concentric circle having a predetermined radius, which were ~~[[was]]~~ measured for a ~~as to the~~ drop of 5 mm and of 25 mm. According to the experimental results ~~result~~ shown in Table 2, the ~~delay of~~ diffusion time was approximately 1.5 second, even when the horizontal distance from the drop position to the plane center of the absorbent core was 25 mm, which is within a tolerance of an absorbent article. In addition, a liquid flow free surface of approximately 50 mm in diameter in which its center was the drop position was observed on the surface of the absorbent core when the liquid flowed out. Accordingly, it is apparent from the experimental results that liquid absorbency can be greatly improved by locating a hidden passage ditch ~~for dividing an absorbent core within a circle having a radius of 25 mm from a plane center of an absorbent core when an outlet for liquid is positioned at the plane center of the absorbent core.~~

Table 2 **SPREADING TIMES FOR SALINE SOLUTION ON THE COMPARISON EXAMPLE OF THE ABSORBENT ARTICLE**

Radius of Circular Diffusion Circle Of Liquid	Horizontal Distance from Liquid Outlet to Surface of Absorbent Article	
	Diffusion Time with Distance of 5 mm	Diffusion Time with Distance of 25 mm
10 mm	0.7 second	0.8 second
20 mm	1.2 second	1.0 second
30 mm	1.8 second	1.4 second
40 mm	2.7 second	2.1 second
50 mm	3.0 second	3.3 second

[0049] In an absorbent article of the invention, since a hidden passage ditch ~~(hidden ditch)~~ dividing ~~[[a]]~~ the flat absorbent core into a plurality of parts functions as a guide for

liquid discharged onto the absorbent article, the liquid discharged approximately to the center of the absorbent article can be quickly guided to the periphery. Moreover, the front or back sheet in the absorbent core, an inner sheet is not pressed into the absorbent core, not even into a section of the core adjacent to the hidden passage, a ditch which is commonly seen because of that in conventional absorbent articles, so that which allows the absorbent core of the absorbent article of the present invention is allowed to utilize its entire absorption capacity to perform its essential absorbent capability.

**[0050]** According to the present invention [[,]] liquid discharged to the surface can diffuse ~~diffusely osmose~~ into the whole absorbent core with little wet back amount, which improves the absorbent efficiency of [[a]] the base material that makes up the ~~comprised in an absorbent core~~. As a result, the amount of the ~~such a base material for~~ absorbing a given ~~the same~~ amount of body fluid can be reduced, so that the invention provides an improved absorbent article, such as a resource saving or waste saving type disposable diaper or sanitary napkin ~~can be provide.~~

## REMARKS

The foregoing is a marked-up copy of the specification of originally filed U.S. Patent Application, Ser. No. 10/529,890, which has been filed under M.P.E.P. 608.01 (q) to show that no new matter has been entered in the preparation of the clean copy substitute specification for the amendment dated April 12, 2007.

The added paragraphs to the summary section are based on disclosure in the examples section and in the description of preferred embodiments. No new matter has been added.

Note that the headings for each example in the original specification were underlined. It is suggested that the underlining should be preserved in the substitute specification. The headings for the examples are shown underlined in the above marked-up copy of the specification, but this underlining is not indicative of a change. On the other hand, the heading for example 7 was not in the correct position in the original specification and lacked underlining. The specification has been amended to correctly position this heading and the fact that it should be underlined is indicated with double underlining.

The substitute specification has been filed to make the corrections in the description in the specification required on pages 2 and 3 of the Office Action. Also a cross-reference to the priority document and standard section headings recommended by the U.S. rules were added. Numerous corrections have been made in the specification to provide a disclosure in grammatically correct idiomatic English with



proper terminology that would be acceptable to one skilled in the art.

A clean copy of the substitute specification accompanies this marked-up copy as required by the rules.

The substitute specification is warranted to contain no new matter.

Should the Examiner require or consider it advisable that the specification, claims and/or drawing be further amended or corrected in formal respects to put this case in condition for final allowance, then it is requested that such amendments or corrections be carried out by Examiner's Amendment and the case passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing the case to allowance, he or she is invited to telephone the undersigned at 1-631-549 4700.

In view of the foregoing, favorable allowance is respectfully solicited.

Respectfully submitted,

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